N 536 - Utilization of Nursing Research in Advanced Practice, Summer 2008

Tzeng, Huey-Ming

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Research Design

Contributors
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Design Characteristics

- Maximizes control over factors to increase the validity of the findings
- Guides the researcher in planning and implementing a study
Level of Control: Quantitative Research

- Descriptive
- Correlational
- Quasi-experimental
- Experimental

Increased Control with Design
Concepts Relevant to Research Design (1)

Causality

A  \[\rightarrow\]  B
Pressure  \[\rightarrow\]  Ulcer

Multicausality

Years smoking  \[\rightarrow\]  Heart disease
High fat diet  \[\rightarrow\]  Heart disease
Limited exercise  \[\rightarrow\]  Heart disease
Concepts Relevant to Research Design (2)

- Probability: Likelihood of an outcome
- Bias: Slanting findings
- Manipulation: Treatment
- Control: All phases of design
Design Validity

- **Measure of accuracy of a study**

- **Examined with critique of the following dimensions:**
  - Statistical conclusion validity
  - Internal validity
  - Construct validity
  - External validity
Elements of a Strong Research Design (1)

- Controlling the environment of the study setting

- Levels of controlling:
  - Natural setting
  - Partially controlled setting: e.g., clinics
  - Highly controlled setting: e.g., laboratory
Elements of a Strong Research Design (2)

• Controlling the equivalence of subjects and groups
  ○ Random subject selection
  ○ Random assignment to groups
Elements of a Strong Research Design (3)

- Controlling the treatment
  - Choose a treatment based on research and practice
  - Develop a protocol for implementation
  - Document the implemented treatment
  - Use a check-list to determine the extent of completeness to which the treatment was implemented
  - Evaluate the treatment during the study
Elements of a Strong Research Design (4)

- Controlling measurement
  - Reliability
  - Validity
  - Number of measurement methods
  - Types of instruments
Elements of a Strong Research Design (5)

- **Controlling extraneous variables**
  - Identify and eliminate extraneous variables via sample criteria, choice of settings, or research design
  - Random sampling
  - Sample: Heterogenous, homogeneous, or matching
  - Statistical control
Problems with Study Designs

- Inappropriate for the study purpose or the research framework
- Poorly developed designs
- The research methods were poorly implemented
- Inadequate treatment, sample, or measurement methods
Selecting a Design

Is there a treatment?
- No
- Yes

Is the treatment tightly controlled by the researcher?
- No
- Yes

Is the primary purpose examination of relationships?
- No
- Yes

Descriptive Design
- No
- Yes

Will the sample be studied as a single group?
- No
- Yes

Quasi-Experimental Study
- No
- Yes

Will a randomly assigned control group be used?
- No
- Yes

Is the original sample randomly selected?
- No
- Yes

Experimental Study
Selecting a Descriptive Design

- Examining sequences across time?
  - No
    - One Group?
      - No
      - Comparative Descriptive Design
      - Yes
      - Data collected across time
        - Studying events partitioned across time?
          - No
          - Cross-sectional design
          - Yes
          - Trend Analysis
    - Yes
    - Following same subjects across time?
      - No
      - Cross-sectional design
      - Yes
      - Repeated measures of each subject
        - Yes
        - Longitudinal design with treatment partitioning
        - No
A Typical Descriptive Design

**Clarification** ➔ **Measurement** ➔ **Description** ➔ **Interpretation**

**Phenomenon of Interest**

- **Variable 1**
- **Variable 2**
- **Variable 3**
- **Variable 4**

**Description of Variable 1**

**Description of Variable 2**

**Description of Variable 3**

**Description of Variable 4**

**Interpretation of Meaning**

**Development of Hypotheses**
A Comparative Descriptive Design

Group I
{variables measured}

Describe

Comparison of Groups on Selected Variables

Interpretation of Meaning

Development of Hypotheses

Group II
{variables measured}

Describe

Research Design
Selecting the Type of Correlational Design

<table>
<thead>
<tr>
<th>Describe relationships between/among variables?</th>
<th>Predict relationships between/among variables?</th>
<th>Test theoretically proposed Relationships?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive correlational design</td>
<td>Predictive correlational design</td>
<td>Model testing design</td>
</tr>
</tbody>
</table>
A Descriptive Correlational Design

Measurement

Research Variable 1

Description of variable

Examination of Relationship

Interpretation of Meaning

Description of variable

Research Variable 2

Development of Hypotheses
A Predictive Design

Value of Intercept + Value of Independent Variable 1 + Value of Independent Variable 2 = Predicted Value of Dependent Variable
Selecting The Type of Quasi-Experimental Design

- **Control Group?**
  - No
  - **Pretest?**
    - No
    - One-group post-test only design
    - Comparison with population values?
      - Yes
      - Repeated Measures?
        - No
        - Strategy for Comparison
          - No
          - Suggest Reevaluating design
          - One group pretest/post-test design
          - Yes
          - Compare treatment & control conditions?
        - Yes
      - Yes
    - Yes
  - Yes
  - Repeated Measures?
    - No
    - Yes
    - Yes
Selecting The Type of Experimental Design

- **Pretest**
  - No
    - Post-test only control group design
  - Yes
    - Repeated Measurements?
      - No
        - Examine effects of confounding variables?
          - No
            - Multiple sites?
              - Pretest/post-test control group design
            - Randomized clinical trials
          - Yes
            - Blocking?
              - No
                - Comparison of multiple levels of treatment
                  - No
                    - Examination of complex relationships among variables in relation to treatment
                  - Yes
                    - Nested Designs
              - Yes
                - Randomized Block Design
## Pretest-Post Test, Control Group Designs

<table>
<thead>
<tr>
<th>Experimental Group</th>
<th>Measurement of Dependent Variables</th>
<th>Manipulation of Independent Variables</th>
<th>Measurement of Dependent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomly selected experimental group</td>
<td>PRETEST</td>
<td>TREATMENT</td>
<td>POST-TEST</td>
</tr>
<tr>
<td>Randomly selected control group</td>
<td>PRETEST</td>
<td></td>
<td>POST-TEST</td>
</tr>
</tbody>
</table>

**Treatment:** Under control of researcher

**Findings:**
- Comparison of pretest and post-test scores
- Comparison of experimental and control groups
- Comparison of pretest-post-test differences between samples

# Post-Test-Only Control Group Design

<table>
<thead>
<tr>
<th>Measurement of independent variables</th>
<th>Measurement of dependent variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomly selected experimental group</td>
<td>TREATMENT</td>
</tr>
<tr>
<td>Randomly selected control group</td>
<td></td>
</tr>
</tbody>
</table>

**Treatment:** Under control of researcher

**Findings:** Comparison of experimental and control groups


**Uncontrolled threats to validity:**
- Instrumentation
- Mortality
- Limited generalizability as control increases
## Nested Design

### Pain Control Management

<table>
<thead>
<tr>
<th>Traditional care</th>
<th>Unit A</th>
<th>Unit B</th>
<th>Unit C</th>
<th>Unit D</th>
<th>Unit E</th>
<th>Unit F</th>
<th>Unit G</th>
<th>Unit H</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRN Medication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New approach: &quot;Around the clock&quot; medication</td>
<td>Unit E</td>
<td>Unit F</td>
<td>Unit G</td>
<td>Unit H</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Care</th>
<th>No Primary Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit A</td>
<td>Unit B</td>
</tr>
<tr>
<td>Unit C</td>
<td>Unit D</td>
</tr>
<tr>
<td>Unit E</td>
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<tr>
<td>Unit G</td>
<td>Unit H</td>
</tr>
</tbody>
</table>
Advantages of Experimental Designs

- More controls in design and conducting a study
- Increased internally validity
  - Decreased threats to design validity
- Fewer rival hypotheses
Advantages of Quasi-Experimental Designs

- More practical
  - Ease of implementation
- More feasible
  - Resources, subjects, time, setting
- More generalizable
  - Comparable to practice
Developing the Design Section of Your Proposal

- Identify the design
  - Name it specifically
- Provide a map of the design
- Discuss your rationale for using this design
- Describe threats to the validity of the chosen design